

ment of the avenue, and four others at distances averaging 100 feet apart nearer the further recognisable extremity, and their directions were measured with the theodolite, independently by two observers, the reference point being Salisbury Spire, of which the exact bearing from the centre of the temple had been kindly supplied by Colonel Johnston, R.E., the Director-General of the Ordnance Survey. The same was also measured locally by observations of the sun and of Polaris, the mean of which differed by less than $20''$ from the Ordnance value. The resulting observations gave for the axis of the avenue nearest the commencement an azimuth $49^{\circ} 38' 48''$, and for that of the more distant part $49^{\circ} 32' 54''$. The mean of these two lines drawn from the central interval of the great trilithon, already referred to, passes between two of the sarsens of the exterior circle, which have an opening of about 4 feet, within a few inches of their middle point, the deviation being northwards. This may be considered to prove the close coincidence of the original axis of the temple with the direction of the avenue.

This value of the azimuth, the mean of which is $49^{\circ} 35' 51''$, is confirmed by the information also supplied from the Ordnance Office that the bearing of the principal bench mark on the ancient fortified hill, about eight miles distant, a well-known British encampment named Silbury or Sidbury, from the centre of the temple is $49^{\circ} 34' 18''$, and that the same line continued through Stonehenge to the south-west strikes another ancient fortification, namely Grovely Castle, about six miles distant and at practically the same azimuth, viz. $49^{\circ} 35' 51''$. For the above reasons $49^{\circ} 34' 18''$ has been adopted for the azimuth of the avenue.

The present solstitial sunrise was also watched for on five successive mornings, viz. June 21 to 25, and was successfully observed on the latter occasion. As soon as the sun's limb was sufficiently above the horizon for its bisection to be well measured, it was found to be $8' 40''$ northwards of the peak of the Friar's Heel, which was used as the reference point, the altitude of the horizon being $35' 48''$. The azimuth of this peak from the point of observation had been previously ascertained to be $50^{\circ} 39' 5''$, giving for that of the sun when measured, $50^{\circ} 30' 25''$, and by calculation that of the sun with the limb $2'$ above the horizon should be $50^{\circ} 30' 54''$. This observation was therefore completely in accordance with the results which had been obtained otherwise.

The time which would elapse between geometrical sunrise, that is, with the upper limb tangential with the horizon, and that which is here supposed, would occupy about seventeen seconds, and the difference of azimuth would be $3' 15''$.

The remaining point is to find out what value should be given to the sun's declination when it appeared showing itself $2'$ above the horizon, the azimuth being $49^{\circ} 34' 18''$.

The data thus obtained for the derivation of the required epoch are these:—

(1) The elevation of the local horizon at the sunrise point seen by a man standing between the uprights of the great trilithon (a distance of about 8000 feet) is about $35' 30''$, and $2'$ additional for sun's upper limb makes $37' 30''$.

(2) — Refraction + parallax, $27' 20''$.

(3) Sun's semidiameter, allowance being made for greater eccentricity than at present, $15' 45''$.

(4) Sun's azimuth, $49^{\circ} 34' 18''$, and N. latitude, $51^{\circ} 10' 42''$.

From the above data the sun's declination works out $23^{\circ} 54' 30''$ N., and by Stockwell's tables of the obliquity, which are based upon modern determinations of the elements of the solar system,¹ the date becomes 1680 B.C.

¹ "Smithsonian Contributions to Knowledge," vol. xviii. No. 232. Table ix. (Washington, 1873.)

It is to be understood that on account of the slight uncertainty as to the original line of observation and the very slow rate of change in the obliquity of the ecliptic, the date thus derived may possibly be in error by ± 200 years.

In this investigation the so-called Friar's Heel has been used only as a convenient point for reference and verification in measurement, and no theory has been formed as to its purpose. It is placed at some distance, as before-mentioned, to the south of the axis of the avenue, so that at the date arrived at for the erection of the temple the sun must have completely risen before it was vertically over the summit of the stone. It may be remarked further that more than 500 years must yet elapse before such a coincidence can take place at the beginning of sunrise.

We have to express our thanks to Sir Edmund Antrobus, Bart., for much kind assistance during our survey; and to Mr. A. Fowler and Mr. Howard Payne, for skilful and zealous cooperation in the measurements and calculations. As already stated, Colonel Duncan A. Johnston, R.E., Director-General of the Ordnance Survey, has also been good enough to furnish us with much valuable information, for which our best thanks are due.

TWO BOOKS OF TRAVEL.¹

IN its general scope and character the first-named of these two works is very similar to Hudson's "The Naturalist in Plata"; the one giving as excellent a picture of wild animal life in the more remote parts of the United States as the other does for the Argentine Republic. Mr. Fountain, although evidently not a trained naturalist, appears to be an excellent observer of the habits of animals, and many of the facts he records, if not new, are certainly not matters of common knowledge. So far as the title is concerned, it might well be concluded that the work is a record of observations made during recent travel, but this is far from being the case, the author's journeys having been made during the 'sixties and early 'seventies, when a large part of the territory of the United States was more or less unexplored, and when the bison still swarmed in its untold thousands on the prairies. Consequently, in many respects, the observations on the fauna of the various districts traversed and on the habits and distribution of the larger mammals are far more valuable and important than any which could be made at the present day. It is perhaps to be regretted that greater pains were not taken to identify some of the animals referred to, which would have avoided certain corrections made in the appendix and have considerably increased the value of the work. Not improbably, however, the author may have had only his notes, and not actual specimens, to rely upon; and if this be so, he may well be excused the lack of the details in question. Taken altogether, with a certain allowance for more or less pardonable faults, it may truly be said to be one of the most delightful works of its kind that it has been our pleasure to read for a very long time, and it may be recommended to all lovers of Nature and a life in the wilds without a shadow of reserve.

To judge from its title (in the selection of which we think the author has scarcely done himself justice) the work might well have been taken for a record of travel, but, as a matter of fact, a very large proportion of it is

¹ "The Great Deserts and Forests of North America." By Paul Fountain. Pp. ix + 295. (London: Longmans, Green and Co., 1901.) Price 9s. 6d. net.

"Sunshine and Surf; a Year's Wanderings in the South Seas." By D. B. Hall and Lord Albert Osborne. Pp. xiv + 320. Illustrated. (London: A. and C. Black, 1901.) Price 12s. 6d.

devoted to natural history. In the first two chapters the author describes the leading features of the fauna of the Mississippi prairies at a time when, in many parts, it still existed in its pristine abundance. Like most amateur naturalists, Mr. Fountain is on the side of those who take a broad view of the limits of species, and we can fully endorse his remarks as to the close relationship of the American wolves to their Old World cousin. When, however (p. 5), he says that the American bison is a mere variety of the European species, and that the differences between the two animals are very slight, we take leave to differ from his opinions. And before

which is devoted to a description of Arizona and its fauna at the time when that State was an almost unknown land. This journey was made in 1871, only two years after Cope had described the poisonous lizard of Arizona, the so-called Gila monster (*Heloderma suspectum*), as a species distinct from the Mexican form. The author's account of its habits is probably one of the earliest on record, his description of how he found out its poisonous nature being an excellent instance of his careful observation.

The remaining three chapters deal with the Yosemite Valley and California and Colorado generally ; and it is with a feeling of regret that limitations of space prevent our alluding to these otherwise than by name.

Very different in character from the first is the second of the two books named at the beginning of this notice, which is in the main the description of a trip to a number of the islands of the South Seas, with observations on their inhabitants and a few scattered notes on their natural history. Pleasantly written and beautifully illustrated, this work appeals more to the general reader and traveller than to the naturalist ; and, in spite of the existence of such books as Kingsley's "The Earl and the Doctor" and Stevenson's "South Seas," both the former will scarcely fail to find much to interest them in its pages. The first visit of the authors was to Tahiti, with which they appear to have been as delighted—alike as regards scenery, climate and the people—as have all previous visitors. Of greater interest is the account of their visit to the Marquesas ; and the excellent photograph of a Marquesan high-priest standing alongside a stone idol (herewith reproduced) should be of value to anthropologists as representing a phase of savage life rapidly on the wane. Among other interesting photographs, special mention may be made of one of a "Maori Belle" and a second of a "Samoaan Beauty," the latter exhibiting the supreme development of the handsome Polynesian type. We should, however, like to know whether the Maori girl is pure-bred or a half-caste. In the islands under French rule, where it was formerly the universal custom, tattooing, the authors tell us, has been prohibited in the case of females, with a corresponding improvement in their personal appearance—at least from a European point of view. It may be added that much interesting information will be found with regard to the administration of the islands under French rule.

Much interest also attaches to the too brief remarks with regard to the feral goats, sheep and cattle—the descendants of animals introduced in 1813—now found in the interior of the Marquesas. The pleasures—and dangers—of reef-fishing are alluded to in some detail ; and the authors endorse previous observations as to the diving powers of the natives, some of whom, they assert, are able to remain under water for four minutes at a time. A novel mode of shark-fishing, in which a diver fixes a running noose round the tail of the victim, is also described. But even in the South Sea Islands life has some drawbacks ; and the authors speak in bitter terms of the miseries they

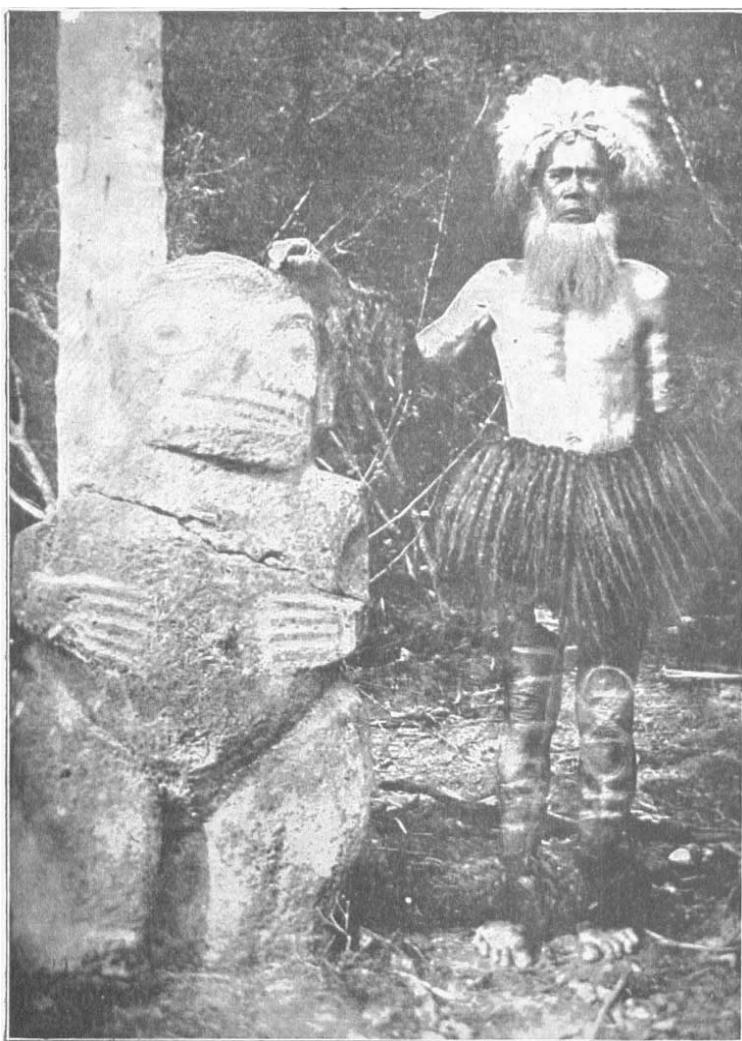


FIG. 1.—A Marquesan High-Priest, with girdle of human hair, and stone idol. (From "Sunshine and Surf.")

putting in print a statement as to his doubts whether the number of ribs in the two is or is not identical, he might surely have taken the trouble to visit a good museum or consult some standard work on the subject.

A different phase of animal life is presented in the chapter entitled "A Day in a Cypress Swamp" ; while in a later one (v.) we have many interesting observations on insects. The seventh chapter is devoted to the red man, who in some respects is viewed in a more favourable light than by many other writers. Of especial interest is the chapter headed "A Little Bit of the Desert,"

endured from sand-flies, centipedes and mosquitoes on certain islands, and from monstrous cockroaches on board the vessels in which they made some local trips.

R. L.

NOTES.

THE close attention which the Emperor of Germany gives to scientific and technical subjects, and the personal interest he takes in the work of men who study them, have been shown on many occasions. The latest instance occurred on Monday, when, attended by a large naval staff, he was present at the annual general meeting of the Society of Naval Architects, founded three years ago on the plan of our own Institution of Naval Architects. The *Times* correspondent at Berlin states that the chief item in the programme was a lecture by Geheimrath Brinkmann on the changes which have been adopted in the disposition of guns in battleships and the results of these changes upon naval architecture. The lecturer pointed out the reasons which had caused the arrangement of the guns with the sole object of firing broadsides to be superseded. He spoke of the beginnings of independent systems of construction in Italy, in the United States and, to a certain extent, in Germany. In the course of the discussion reference was made to the advantage which Germany enjoyed in having the opportunity of constructing an entirely new navy while profiting by the experience of older naval powers, and it was pointed out that, as regards materials, German steel was excelled by none. To the surprise of the audience, the Emperor ascended the platform, and after beckoning all who were present to remain seated, spoke upon the subject of the influences of military requirements upon the development of naval construction and the disposition of artillery on ships. The presence of the Emperor at scientific and technical meetings is itself a mark of sympathy with their aims; and when, in addition, he shows himself keenly interested in the subjects discussed, the influence upon the public mind must be very great. To this influence must partly be ascribed the regard in which scientific investigation is held in Germany.

CONSIDERABLE interest attaches to a circular said to have been issued by the Italian War Office to the veterinary surgeons of the Italian Army. The circular recommends to their attention a new treatment for the so-called foot and mouth disease of cattle. The treatment was announced some little time ago by Prof. Bacelli, and consists in the intravenous injection of a solution of perchloride of mercury and sodium chloride. The intravenous injection of powerful antiseptics for specific diseases is, of course, not new. Quite recently intravenous injections of formic aldehyde were used, apparently with success, in the treatment of human pulmonary tuberculosis. We have not, up to the present, had access to the actual communication either of Prof. Bacelli or of Dr. Guzzi, who appears to have been the first to actually use the remedy in question; but it appears that the injected fluid consisted of 1 gramme of perchloride of mercury, 75 grammes of sodium chloride and 1 litre of water, and that of this solution first 30, then 50, then 70, and subsequently 100 cubic centimetres were injected. As the body-weight of the animals in question is unknown, an accurate estimation of the dose given is impossible. The ultimate remedial agent is the albuminate of mercury. The addition to the injecting fluid of the sodium chloride renders this substance more soluble, and also tends to prevent the precipitation of proteins by the perchloride, and hence the formation of emboli. The animals treated all appear to have been cured of the disease. From the general standpoint, these results, if accurate, are of interest in that they afford another instance of the possibility, by the intravenous injection of an antiseptic, of destroying, or at any rate influencing, the maladies morbi without injuring the host.

A CORRESPONDENT informs us that the tercentenary of Tycho Brahe's death was celebrated in Basle, Switzerland, where Tycho settled for a time and revived interest in astronomical science. The Society of Naturalists of Basle met, with several other scientific societies, on October 23 in the Bernoullianum to listen to a lecture by Prof. Fritz Burckhardt on Tycho in Switzerland. A facsimile was shown of the letter, the original of which is preserved in the university library of Basle, with which Baron Hoffmann introduced Kepler to Tycho.

MR. A. J. EVANS, F.R.S., keeper of the Ashmolean Museum at Oxford, has been elected a corresponding member of the Munich Academy of Sciences.

WE learn from the *British Medical Journal* that on January 1, 1902, the Imperial Leopold Caroline Academy of Sciences, which has its headquarters at Halle, will celebrate the one hundred and fiftieth anniversary of its foundation. The Academy is the oldest scientific society in Germany.

THE seventh annual conference of hop growers will be held at the South-Eastern Agricultural College, Wye, on Wednesday, November 27. Colonel A. M. Brookfield, M.P., will preside, and reports will be presented on experiments conducted during 1901 on the manuring, drying, training and cultivation of hops.

THE adoption of the metric or decimal system of coinage, weights and measures in South Africa was advocated by Mr. Hutchins in a paper read before the South African Philosophical Society on October 2. It was shown that with very slight modifications the present coins and measures could be adapted to the decimal system. At the close of the meeting it was decided that a committee, consisting of Sir David Gill, Dr. Muir, Dr. Beattie, Prof. Thomson, Dr. Crawford, Mr. Littlewood and Mr. Hutchins (with power to add to their number), should prepare a report on the advisability of introducing or legalising the metric system of weights, measures and coinage in South Africa.

MR. J. STIRLING, Government Geologist and Mining Representative of Victoria, gave a lecture at the Imperial Institute on Monday on "Brown Coal-beds of Victoria, their Characters, Extent and Commercial Value." The question of utilising the large deposits of tertiary fuel known to exist in the Latrobe Valley, Gippsland, at Newport near Melbourne, Lal Lal near Ballarat, Dean's Marsh near Geelong, and at other places in Victoria, to commercial advantage in the interests of the State, is of considerable importance at the present time, when each portion of the Australian Commonwealth is taking stock of its natural resources. Geological sections run across the Latrobe Valley from north to south have disclosed the phenomenal thickness of the Morewell beds. A bore put down by the Government at Maryvale, near Morewell town, has proved 780 feet of brown-coal, in beds more than 260 feet in thickness. The chemical analyses of this fuel, taken from the bore at different levels down to 987 feet from the surface, have shown that its heat-giving qualities increase with the depth, there being from 36.75 per cent. of fixed carbon in the upper beds and 48.30 per cent. in the lower. Six hundred square miles of these tertiary brown-coal beds are known to exist in Victoria, of which 300 square miles, with 31,144,390,000 tons of the fuel, occur in the Latrobe Valley. From his intimate knowledge of these brown-coal deposits, and from the recent studies he has made on the Continent of Europe of the methods there adopted of utilising brown-coal by manufacturing it into briquettes, distilling paraffin and oils from it and producing various by-products, for all of which this class of fuel was especially adapted, Mr. Stirling has arrived at the opinion that Victoria possesses the makings of an